

MHATRE-PCT-1

1

**" A NEW DIFFUSER IN CENTRAL AIR CONDITIONING SYSTEM "**

This invention relates to the new Diffuser for central air conditioning system and the incorporated parts of Diffuser namely Flower or Centre Core, Core Assembly, Outerframe, etc. and the method of manufacturing the same.

5 In a central air conditioning system, the air is conditioned to a desired temperature at one source is distributed at various places through network of ducts and diffuser is required at every outlet of the duct.

Generally these ducts are of square or rectangular cross section, most probably due to their easy self-resting and properly adjusting nature in corners of the ceiling in the  
10 buildings and vehicles, and therefore the diffuser used at the outlet of an distribution duct is also of square or rectangular in shape.

The diffuser fitted at the end of the air distribution duct projects/exposes out from the ceiling of a room or any other space required to be air conditioned and therefore it plays a part in interior decoration or all over look of the room/space.

15 The diffuser mainly consists of an outer frame having a square/rectangular collar, according to the cross-section of the duct, an outwardly slanting surface at all the four sides projecting downward from the said collars and then a substantially horizontal flange, the outer free edge of which is bent upward, a centre core for blocking/preventing the air stream coming through the duct from escaping out centrally  
20 with a force and diffusing it in all sides and one or more intermediate cores provided in between the centre core and each of the intermediate cores are having a square/rectangular collar, an outwardly slanting surface at all the four sides projecting downward from the said collar and then ending into a substantially horizontal flange.

The centre core and the intermediate core (s) are assembled together in a spaced-apart  
25 manner, keeping the slanting surfaces parallel to each other with the help of at least a pair of rods/pipes passing through the collars and attached to the collar of the outer frame in a easily detachable manner, and kept in position with the help of biased springs.

The outer frame in turn is attached to the outlet of air distribution duct.

The diffusers are manufactured in various sizes to be used according to the size or  
30 volume of room or space to be air conditioned. Generally the size of centre core is same in all the diffusers but the number of intermediate cores varies according to the size of the outer frame.

## MHATRE-PCT-1

2

The cores and the outer frame of the existing diffusers are made of four side sections, which are assembled together by using four corner sections. Each side section consists of a vertical portion at top, a downwardly slanting portion in middle and a horizontal flange at the bottom. The slanting portion of each core section and horizontal flange of outer frame is provided with a grooved channel section on its back surface to accommodate the corner sections on assembly. The horizontal flange of each side sections of the outer frame may also be bend upwardly and outwardly at the outer periphery.

The existing diffusers suffer from the following drawbacks :

1. When the diffuser is attached to the duct and the conditioned air is blown through the duct it is noticed that the air is not diffused equally on all sides as the corner sections and the grooved channel sections and ridges at the back surfaces of the cores come in the path of air and disturbs the equal and proper diffusion of air in the path of air and disturbs the equal and proper diffusion of air in all directions. The enclosed collars of the centre core and intermediate core(s) rebounds the air and thereby reducing the flow of air through corners of the diffuser.
2. As the diffuser is manufactured in several pieces and then the various pieces are assembled, thus manufacturing process is cumbersome, time consuming and labour oriented which increases the cost of production.
3. On assembly some times there remains a gap between two side sections, at the corners of the core(s), due to which diffusers are rejected resulting into a big loss of production i.e. material and labour and which increases the cost of production.
4. To avoid gaps at the corner of the core(s) the side sections of the cores are produced with high precision and which increases the cost.
5. Due to the grooved channel sections at the backside section and corner sections used for the assembly of cores the weight of the diffuser is increased which also increases the cost of production.
6. Some time the side sections of each core and outer frame are welded together at corners, to avoid gaps, or corner sections after fixing into the crimped for 3 assembly. The cores are interconnected through connecting strips, welded to the collars of each core. The welding and crimping operations require extra equipment as well as these operations are very time consuming there by increasing the cost of production.

MHATRE-PCT-1

3

7. Due to the grooved channel sections and corner sections or ridges and welding spots on the back surface of the core(s) the dust is accumulated therein, which is difficult to clean.
8. The dust is also accumulated in the gaps at the corners on the front surface of the cores, which gives a dirty look to the diffuser and tarnish the interior decoration/look of the room/space.

The main object of this invention is to obviate the above mentioned Drawbacks of the existing diffusers and to provide a new diffuser for central air conditioning system wherein each of the central core and / or the intermediate core(s) and/or the outer frame are manufactured in a single piece and both the outer as well as inner surfaces of the cores and/or the outer frame are smooth without any extra section, projection or groove which dispenses with the requirement of extra material,

And the time taken for assembly is also very much reduced and at the same time there is no obstacle in the flow path of air which is diffused equally in all the directions. As the cores are manufactured in a single piece there is no question of any gap at the corners thus no chance of rejection of the product and no need of any welding or joining or crimping operation and hence the cost of production of the diffuser will be obviously very less.

Another object of this invention is to provide a new diffuser wherein the enclosed corners of the diffusers at the back side of the cores are removed to avoid air flow from all the corners of the diffuser, thus the air distribution is proper and equal in all the direction. A further object of this invention is to provide a new diffuser wherein dust accumulation on front as well as back surface of the cores and outer frame is minimized due to both surfaces being smooth. There is no problem in dust cleaning and as there is no gap at corners, no dust accumulation and hence the diffuser which may be coated in any desired colour appears always clean and nice.

A further object of this invention is to provide a Diffuser, which is light in weight and easy to manufacture and easy to store and transport.

According to a further object of this invention, the Centre core, intermediate core (s) and outer frame, each of which are of single piece construction, can be manufactured, stored and transported separately and easily assembled ever when required to form a new diffuser or can be used as a separate part/spare part for replacement in an existing

MHATRE-PCT-1

4

diffuser. Thus according to this invention, a single piece Centre Core, at least one intermediate Core and an Outer Frame, for the new Diffuser for use in central air conditioning system, said Centre core comprises of an outwardly and downwardly directed slanting surface originating from a Centre point/apex and ending into a peripheral flange at its bottom and being made in a single piece having its inner and outer surfaces smooth, a plurality of spaced apart vertical strips having a pair of holes on the opposing vertical sides,

At least one or more plurality of said one piece intermediate Core for said diffuser comprises of a vertical collar at the top, an outwardly and downwardly directed slanting surface and a peripheral flange at its bottom and being made in a single piece having its inner and outer surfaces smooth, a plurality of opposite vertical sides of the collar being provided with at least a pair of opposing holes,

A single piece Outer frame, for the said diffuser comprises of a stepped vertical collar at the top, an outwardly and downwardly directed slanting surface and a peripheral flange at its bottom, the outer free edges of the said flange preferably being bent upwards and being made in a single piece having its inner and outer surface smooth, the two opposing sides of the said vertical collar being provided with at least a pair of opposite holes;

Said centre core, intermediate core (s) and the outer frame forming constituent parts of said new diffuser.

According to further feature of this invention, the method of manufacturing said new diffuser having said centre core, intermediate core (s) and outer frame comprises of the following steps :-

- a) making the said centre core in single piece with the help of suitable dies in a sheet metal press, carrying the operations of cutting and bending, having its inner and outer surfaces smooth;
- b) making the said intermediate core(s) in single piece, with the help of suitable dies, in a sheet metal press, carrying the operations of cutting, bending and piercing having its inner and outer surface smooth;
- c) making the said outer frame in single piece, with the help of suitable dies, in a sheet metal press, carrying the operations of cutting, drawing, bending and piercing having its inner and outer surface smooth;
- d) attaching the said Centre Core with the said intermediate core(s) keeping their

## MHATRE-PCT-1

5

- slanting surfaces parallel to each other by passing at least a pair of rods/pipes or sections of the shape of the hole, through the holes provided in the said vertical strips integrally provided on the vertical face at the backside of the said centre core and through the holes in the vertical collars of the said intermediate core(s);
- 5 e) attaching the assembly of above step (d) to the outer frame with the help of the said rods/pipes/sections of shape of hole, the free ends of which passing through the holes provided in the opposing sides of the vertical collar of the said outer frame, one end of the said pair of rods/pipes being kept spring biased for easily detaching the assembly of said cores from the outer frame;
- 10 f) painting, plating or powder coating the said centre core, intermediate core(s) and the said outer frame separately or in assembly.

The invention will be clear from the following description when described with reference to accompanying drawing wherein.

|    |               |                                                                                                                                                                       |
|----|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 | Fig.1         | Shows in plan, the existing Diffuser Assembly                                                                                                                         |
|    | Fig.2         | Shows the sectional elevation of figure 1 alongwith the direction of air flow and change due to obstacles in the flow.                                                |
|    | Fig. 3        | Shows in plan a corner piece used in assembling the various pieces(said sections) of cores and / or outer frame of the existing diffuser                              |
| 20 | Fig.4 & 5     | Shows the plan and elevation respectively, of an embodiment of the new diffuser assembly, according to an embodiment of this invention                                |
|    | Fig. 6,7 & 8  | Show the plan, elevation and end view respectively, of the single piece centre core of the new diffuser, according to an embodiment of this invention.                |
|    | Fig.9,10 & 11 | Show the plan, elevation and end view, respectively of the single piece intermediate core(s) of the new diffuser, according to an embodiment of this invention        |
| 25 | Fig.12 & 13   | Show the plan elevation respectively of the single piece outer frame of the new diffuser, according to an embodiment of this invention the existing diffuser assembly |
|    | Fig.14        | Shows in part perspective view, the new diffuser assembly, according to this invention                                                                                |
| 30 |               |                                                                                                                                                                       |

## MHATRE-PCT-1

6

|                          |                                                                                                                                    |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Fig.15                   | Shows in part sectional elevation the diffuser assembly showing the air flow through the New diffuser according to this invention. |
| Fig. 16, 17, 18, 19 & 20 | Shows the different models of diffusers by increasing the flat flange of outerframe and keeping the outer size as standard.        |

5 Referring to figures 1 to 3, the existing diffuser (1) comprises an outer frame (2), one or intermediate core (s) (3) and a centre core (4). The outer frame (2) is made by assembling four side sections (5) with the help of four corner sections (6) consists of a vertical side (7) which is bent to form an angle (8) at top, and an outwardly slanting surface (9) at bottom and then a substantially horizontal flange (10) the outer free edge of which is bent upward as shown at (11) to give strength. A grooved channel (12) is formed at the upper / back surface of the flange (10) to accommodate corner section (6) on assembly. The four such side sections (5) are assembled together with the help of corner sections (6) and crimped as shown at (13), to hold the various pieces together. The upper vertical sides on assembly form a square or rectangular collar at the top of the outer frame, according to the size of the duct to which the diffuser is to be attached.

The intermediate core (s) (3) is/are also made of four side sections (14) which are assembled together with the help of four corner sections (6). Each side section (14) consists of a vertical side (15), an outwardly and outwardly slanting surface (16) and a substantially horizontal flange (17). The slanting surface (16) is provided with grooved channel (12) at its top/back surface for accommodating a corner section (6) on assembly. Four such side sections (14) are assembled together with the help of four corner sections (6) which are crimped together as shown by numeral (13) to hold the various pieces together. The upper vertical sides (15) of the said sections (14) form an enclosed square or rectangular collar at the top of intermediate core (3). A pair of holes (18) are provided in two opposite vertical sides (15) for passing there through a pair of rods (19) for holding the centre core (4), intermediate core (s) (3) and outer frame (2) together.

The centre core (4) is also made of four side sections (20) which are assembled together with the help of four corner sections (6). Each side sections (20) consists of a vertical side (21), an outwardly and downwardly slanting surface (22) extending up to the central point and a substantial flange (23). The slanting surface for accommodating corner sections (6) on assembly, contains grooved channels on the back side. Four such side

**MHATRE-PCT-1**

7

sections (20) are assembled together with the help of four corner sections (6) which are crimped together to the centre core (4), having an enclosed collar at the top. Two plates (24) are riveted to the two opposite vertical sides (21) through which two pairs of opposing holes (25) are provided for passing there through the pair of rods/pipes (19) to  
 5 hold the centre core (4) with the intermediate core(s) (3) and outer frame (2).

Generally after assembly of various sections, gaps (26) are noticed at the corner of intermediates core(s) (3) and centre core (4) which result into rejection of the product/diffuser.

Further the grooved channels (12) and the corner sections (6) on the back surface  
 10 of the cores rebounds the air flow and disturbs the equal and proper diffusion of air in all directions. The enclosed collars formed by the vertical sides of the side sections of each core on assembly, rebounds the air flow, as shown by arrows in fig.2, which reduces the air flow from the corners and thus the diffusion of air is not proper and equal in all the directions, by the existing diffusers.

15 Besides these deficiencies in the functioning of the existing diffusers, they require more material, labour and time, ultimately resulting into higher cost of the product as well as they are not pleasant in looks, accumulate dust and are difficult to clean specially from the back surface of the cores.

Referring to figures 4 to 15 the new diffuser (27) according to an embodiment of  
 20 this invention comprises an outer frame (28), one or more intermediate core(s) (29) and a single piece centre core (30). The construction of outer frame (28) is similar to the outer frame (2) of the existing diffuser except that the outer frame (28) is preferably made in a single piece there by saving the time and labour used for the assembly of various pieces/sections of outer frame (2) of existing diffuser (1) and at the same time  
 25 grooved channels (12) and corner sections (6) are not required which results into saving in the material also.

The intermediate core(s) (29) of the new diffuser (27) is/are preferably made in a single piece and thus the grooved channels (12) are not provided on the slanting surface. Further corner sections (6) are also not required. According to this invention the vertical  
 30 collar (31) of the intermediate collar(s) (29) is not an enclosed collar i.e. the four corners of the vertical collar (31) are not provided i.e. there are formed clear slots (32 & 33) at the four corners, as shown in fig. 9, 10 & 11. The two opposing vertical sides (34) are

## MHATRE-PCT-1

8

provided with two pairs of opposing holes (25) for passing there through a pair of rods (19) for attaching the intermediate core(s) there is no assembling operation for individual core or flower or outerframe, hence saving in material, labour & time. Further as the enclosed collar is avoided i.e. the four corners of the vertical collar are provided with slots (32 & 33), there is no rebounding of air due to grooved channels and corner sections on the back side of slanting surfaces of the cores which are clear and smooth, being formed of a single piece. There is also a clear flow of air through the slots (32 & 33) at the corners, without any disturbance unlike in the cores (3) of the existing diffusers (1).

The centre core (30) of the new diffuser (27) is essentially made in a single piece and consists of a outwardly and directed slanting surface (35) originating from a central point and ending into a substantially horizontal flange at the bottom and thus there is no grooved channel (12) on the back side of slanting surface (35) and also corner sections (6) are not required. Further according to this invention there is no vertical sides provided at the top of the slanting surface (35) and thus there is no enclosed collar. For attaching the centre core (30) to the intermediate core(s) (29) and the outer frame (28), two spaced apart vertical strips (36), having a pair of opposing holes (25), for passing there through a pair of rods/pipes (19), are formed integrally at the slanting surface (35). Supporting ribs (37) may also be provided.

In the centre core there is no grooved channel (12) corner sections (6) and vertical collars has also been dispensed with there by saving in material, time and labour. Further there is no gap being in single piece, hence there is no chance of rejection of air at the corners thus giving an equal and proper distribution of air in all the directions which is clearly shown by arrows in the fig. 15. The method of manufacturing the new diffuser, and/or its various parts, according to the preferred embodiment of this invention, are as follows:

1. The centre core (30) consisting of an outwardly and downwardly directed slanting surface (35) originating from a central point (apex) and ending into horizontal flange manufactured by of suitable dies, in a sheet metal press, having its inner and outer surface smooth. Two spaced-apart vertical strips (36) having a pair of opposing holes (25) are integrally formed on the upper/back side of the slanting surface (35) and supporting ribs (37) may also be provided. The single

## MHATRE-PCT-1

9

piece centre core manufactured as above (30) is without any grooved channels and corner sections manufactured as above, may be stored and/or transported separately and may be used for the assembly of new diffuser or for replacement in an existing diffuser.

- 5     2.     The intermediate core(s) (29) consisting of a vertical collar (31) at the top, an outwardly and downwardly directed slanting surface and a flange at the bottom, is made in a single piece with the help of suitable dies, in a sheet metal press, having its inner and outer surface smooth. The four corners of the vertical collar (31) are cut to form clear slots (32, 33) and the two opposing vertical sides (34)  
10     are provided with a pair of opposing holes (25). The single intermediate core(s) (29) without having any grooved channels and corner sections manufactured as above, may be stored and/or transported separately and may be used for the assembly of new diffuser or for replacement in an existing diffuser.
- 15     3.     The outer frame (28) consisting of a stepped vertical collar, an outwardly and downwardly directed slanting surface and a flange with its outer free edge bent upwards, is made in a sheet metal press having its inner and outer surface smooth. The two opposing sides of the vertical collar are provided with at least a pair of holes. The single piece outer frame without having any grooved channels and corner sections, manufactured as above, may be stored and/or transported  
20     separately and may be used for the assembly of new diffuser or for replacement in existing diffuser
4.     The centre core (30), intermediate core(s) (29) and the outer frame (28) are painted, plated or powder coated in a desired colour.
- 25     5.     For assembling the new diffuser, the centre core (30) and the intermediate core(s) are assembled first, keeping the slanting surfaces parallel to each other and passing a pair of rods/pipes through the holes (25) provided in the vertical strips(36) and in the vertical sides (34) of the vertical collar (31). The outer frame (28) is now attached by passing the free ends of the rods/pipes through the holes in the vertical collar of the outer frame. One end of the said rods/pipes is kept  
30     spring loaded/biased for easy detaching the said cores from the outer frame. It is now clear from the above description with reference to figures that the new diffuser required less number of parts hence the weight of diffuser is less, thus

MHATRE-PCT-1

10

5 saving of costly material, labour and time which will reduce the cost. As no assembly of pieces of the individual cores is required, there will be no need of crimping equipment and/or welding equipment. As there are no grooved channels, corner sections and enclosed collars, there is no obstruction to the air flow. As now there is no chance of any gap, there will be no rejection of the final product. The new diffuser will remain very clean. As there is no gap at the corners, hence no dust accumulation giving an aesthetic look and at the same time it will be easy to clean any dirt at the inner surface, being smooth. The new diffuser can be made with the help of suitable dies in a sheet metal press and can be powder coated in various colours according to the interior of the room/space and there will not be any dirt on the outer surface giving an ugly look to the nicely painted surface of the new diffuser according to this invention.

10

6. The new outerframes with increasing flat flanges but keeping the outer size as standard size alongwith the new core(s) and centre core also provide diffuser with standard outer size and variable passage of air depending upon number of intermediate cores inside, thus giving standard size for the false-ceiling.

The above description with reference to drawings is given just to understand the invention rather than to limit its scope, as modifications without departing from the main theme of the invention are possible, which will be evident to a person skilled in the art, should also be considered as falling within the ambit and scope of this invention and the appended claims.

## **CLAIMS**

1. Diffuser for a central air conditioning system comprising at least a center core element and at least an intermediate core element;

said center core element comprising a single continuous piece defining an outwardly and downwardly extending slanting wall generally originating from an upper apex and terminating at a lower peripheral edge area, said wall having smooth inner or lower and outer or upper surfaces;

a plurality of generally vertically extending, laterally spaced strips attached to opposite sides of the upper surface of said wall in opposing relationship;

each of said strips having at least one hole/slot for receiving a mounting fastener, each hole/slot of each strip aligned with an opposed hole of an opposed strip;

said intermediate core element comprising an upper, generally vertically extending collar connected at its lower end to an outwardly and downwardly extending wall terminating at a respective peripheral edge area, said wall of the intermediate core having smooth inner or lower and outer or upper surfaces, and said vertically extending collar and outwardly and downwardly extending wall of said intermediate core element being constructed in one continuous piece;

at least one pair of opposed, aligned holes/slots in said collar;

said center and intermediate core elements configured so that the center and intermediate cores may be assembled in nested relationship with the outer or upper wall surface of the center core located centrally within the inner or lower wall surface of the intermediate core element and with all of said opposed holes aligned with each other.

2. Diffuser according to claim 1, including an outer frame element formed in one continuous piece and comprising a generally vertically extending upper collar at its upper area from which extends a downwardly and outwardly extending wall having an inner surface and terminating at a generally horizontally extending peripheral flange area;

said upper collar of said outer frame element having at least one pair of

opposed, aligned holes/slots;

said center core element, intermediate core element, and outer frame element configured so that they may be assembled in nested relationship with the outer or upper surface of said wall of said intermediate core element located centrally within the inner or lower wall surface of said outer frame element and with the outer or upper wall surface of the center core located centrally within the inner or lower wall surface of the intermediate core element and with all of said opposed holes aligned with each other.

3. Diffuser according to claim 2, including at least one generally horizontal rod/pipe connector extending through at least one set of aligned opposed holes to thereby secure against separation the inner core, intermediate core and frame in nested relationship.
4. Diffuser according to claim 1, said vertical collar of said intermediate core element including corner portions removed to define clear slots at that enable free flow of air circulated through the diffuser around the vertical collar.
5. Diffuser according to claim 3, said rod comprising a spring loaded extendible, variable length rod/pipe element.
6. Diffuser according to claim 1, wherein said opposed, aligned holes comprise multiple pairs of horizontally spaced apart aligned opposed holes in said strip and collar elements.
7. Diffuser according to claim 3, wherein said opposed, aligned holes comprise multiple pairs of horizontally spaced apart aligned opposed holes in said strips, intermediate core collar, and upper frame collar elements, and including a generally horizontally extending rod connector element extending through at least holes/slots of two elements or each set of aligned opposed holes to thereby secure against separation the inner core, intermediate core and frame in nested relationship.

8. Diffuser according to claim 6, said rod/pipe connector elements each comprising a spring loaded, variable length rod/pipe, or any other biasing means.
9. Diffuser for a central air conditioning system comprising an outer frame element made in one continuous piece, and including a generally vertical central collar and a downwardly and outwardly extending wall terminating at a peripheral, generally horizontally extending flange having a free edge, said free edge bent back upwardly, whereby when the outer frame is disposed in a ceiling opening, the bent back free edge will engage an adjacent ceiling surface.
10. Diffuser for a central air conditioning system comprising a central core element, at least an intermediate core element, and an outer frame element, said central core element, intermediate core element and frame element each having downwardly and outwardly extending walls configured to enable the elements to be assembled in nested relationship with their walls in spaced, adjacent relationship, said elements each being made in one continuous respective piece and said walls of the central and intermediate core elements terminating at free edges without flanges.
11. Diffuser for a central air conditioning system comprising at least a center core element;  
said center core element comprising a single continuous piece defining an outwardly and downwardly extending slanting wall generally originating from an upper apex and terminating at a lower peripheral edge area, said wall having smooth inner or lower and outer or upper surfaces;  
a plurality of generally vertically extending, laterally spaced strips attached to opposite sides of the upper surface of said wall in opposing relationship;  
each of said strips having at least one hole for receiving a mounting fastener, each hole of each strip aligned with an opposed hole of an opposed strip.
12. Diffuser for a central air conditioning system comprising at least an intermediate

core element, said intermediate core element comprising an upper, generally vertically extending collar connected at its lower end to an outwardly and downwardly extending wall terminating at a respective peripheral edge area, said wall of the intermediate core having smooth inner or lower and outer or upper surfaces, and said vertically extending collar and outwardly and downwardly extending wall of said intermediate core element being constructed in one continuous piece; and at least one pair of opposed, aligned holes/slots in said collar.

13. Diffuser for a central air conditioning system, said diffuser comprising at least a central core element and / or at least an intermediate core element ;  
said central core element comprising a single continuous piece defining an outwardly and downwardly extending slanting wall originating from an upper apex and terminating at a lower peripheral edge area, said wall having smooth inner or lower and outer or upper surfaces;  
said intermediate core element having downwardly and outwardly extending slanting wall portions;  
said central and intermediate core elements configured so that they may be assembled in nested relationship with their respective walls of the central core element and wall portions of the intermediate core element adjacent to and spaced from each other.
14. Diffuser according to claim 13, including a plurality of generally vertically extending, laterally spaced strips attached to opposite sides of the upper surface of said wall of said central core in opposing relationship;  
each of said strips having at least one hole for receiving a mounting fastener, each hole of each strip aligned with an opposed hole of an opposed strip.